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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/243,689	02/03/1999	RICHARD M. WASSERMAN	101473	2795

25944 7590 05/24/2002

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EXAMINER

GARCIA OTERO, EDUARDO

ART UNIT PAPER NUMBER

2123

DATE MAILED: 05/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/243,689

Applicant(s)

WASSERMAN, RICHARD M.

Examiner

Eduardo Garcia-Otero

Art Unit

2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 April 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11, 13-18, 20-27 and 29-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 13-18, 20-27 and 29-44 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 February 1999 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3,4 6) ☐ Other: _____

DETAILED ACTION-Final Action

Introduction

1. Claims 1-44 of US Application 09/243,689 filed on 2/3/99, are presented for examination.
2. This Final Action is in response to Applicant's amendments received 17 April 2002, paper # 8.
3. Claims 12, 19, and 28 have been cancelled.
4. Claim 44 has been added by Applicant.
5. Claims 1-11, 13-18, 20-27, and 29-44 have been examined, and rejected by this Final Action.

Drawings-reference characters

6. **The drawings of this application improperly use reference characters.** "The same part of an invention appearing in more than one view of the drawing must always be designated by the same reference character, and the same reference character must never be used to designate different parts" according to 37 CFR 1.84(p)(4). The drawings are replete with improperly used reference characters. The drawings should be carefully revised to comply with 37 CFR 1.84(p)(4). Some specific examples follow.
7. **The same part of an invention is improperly designated by different reference characters in different views.** Specifically, FIG 1 states "Vision Inspection Control System 12", and FIG 2 states "Vision Inspection Control System 110". Further, Page 4

Art Unit: 2123

line 25 states that these are "identical". This same improper designation problem applies to FIG 1 element 10, and all the subsystems of said element 10.

8. **Additionally, the same reference character is improperly used to designate different parts.** Specifically, FIG 2 "Vision Inspection Control System 110" is different from FIG 3 "Vision Inspection Control System 110". Note that, FIG 2 "shows one exemplary embodiment" at Page 4 line 21 but FIG 3 "shows another exemplary embodiment" at Page 7 line 8. Note that each of these systems has different internal parts. Thus, these are different parts which should be designated by different reference characters.

Request for Information

9. **The Examiner requests copies of the following publications** because they appear to be especially germane to the claimed invention. Applicant is reminded of 37 CFR 1.56. In responding to this request, where the document is a bound text or a single article over 50 pages, the request may be met by providing copies of those pages that provide the relevant subject matter. Specifically, Examiner requests:

10. OpenGL Reference Manual, OpenGL Architecture Review Board, Addison-Wesley Developers Press, Reading, MA, 1996. See Page 9 line 1 of specification.

Mere Reference is not incorporation

11. **Mere reference to another application, patent, or publication is not an incorporation** of anything therein into the application containing such reference for the purpose of the disclosure required by 35 U.S.C. 112, first paragraph. In re de Seversky, 474 F.2d 671, 177 USPQ 144 (CCPA 1973). Specifically, the following ~~mere~~ references have not been incorporated:

12. "OPENGL Reference Manual", at Page 9 line 1.

13. "A Lens and Aperture Camera Model for Synthetic Image Generation", at Page 9 line 29.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459

(1966), that are applied for establishing a background for determining obviousness under

35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

16. Claim 1 (Amended) is rejected under 35 U.S.C. 103(a) as being unpatentable over

Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US

Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1).

17. Claim 1 is an independent claim with three limitations, the third limitation will be

discussed in two parts for clarity: (c1) and (c2).

18. (a) **"a first model representing at least one object"** is disclosed by Kolb et al at page

317, second column, third bullet, "a vision system may want to test whether its internal model of the world matches what is being observed", and alternately disclosed at Page

318, footnote 1, "object space to the left of the lens system".

19. (b) **“a second model representing at least an optical system corresponding to a machine vision system being simulated”** is disclosed by Kolb et al at Page 317, second column, third bullet, “In some machine systems and scientific applications it is necessary to simulate cameras and sensors accurately”, and alternately at Page 318 first paragraph “This paper describes a physically-based camera model for computer graphics. The model is capable of simulating the image formation of a particular physical lens system”.
20. (c1) **“a processor that generates a focus dependent image of a virtual world containing the at least one object based upon the first model and the second model”** is disclosed by Kolb et al at Page 320 first heading “3.3 Focusing”.
21. Kolb does not expressly disclose “user interface representation of a user interface of the machine vision system being simulated”.
22. (c2) **“user interface representative of a user interface of the machine vision system being simulated”** is disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. Note that fighter heads-up displays typically include icons indicating positions of other fighters and the position of the horizon which are acquired by radar, and note that radar is a machine vision system. Thus, the simulated heads-up display is a user interface representative of a user interface of the machine vision system being simulated (fighter radar system).
23. Alternately, (c2) **“user interface representative of a user interface of the machine vision system being simulated”** is disclosed by Streid ‘845 at Column 1 line 49 “Simulation systems provide fully simulated NVG imagery projected onto displays”. Thus, the

simulated heads-up display is the user interface representative of a user interface (NVG or night vision goggles) of the machine vision system (night vision system).

24. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to "reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection" according to Buckley US Patent 6,064,759 Column 1 line 32.
25. **Claim 2 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1).
26. Claim 2 depends from Claim 1 with two additional limitations.
27. **"at least one of the first and second models includes information which characterizes the relative orientation and position"** is disclosed by Kolb et al at Page 319 first column "3.1 Tracing Rays Through Lens System".
28. "the image of the virtual world comprising an image of at least one object as seen through the optical system" is disclosed by Kolb et al at Page 319 first column "3 Lens Geometry and Image Formation".
29. **Claim 3 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 3 depends from Claim 1 with two additional limitations.

Art Unit: 2123

30. Kolb does not expressly disclose “at least one additional model representing a at least one of a stage, a work piece fixture and a lighting system”

31. **“at least one additional model representing a at least one of a stage, a work piece fixture and a lighting system”** is disclosed by Buckley ‘759 at Column 1 line 26 “The system combines SLMV hardware with a computer software simulation of the part, the structured light and the camera’s view. The simulation uses a geometric model software file that can graphically render the pat onto a computer screen.”

32. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

33. **Claim 4 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 4 depends from Claim 3 with one additional limitation.

34. Kolb does not expressly disclose “at least one additional model further represents a stage table”.

35. **“at least one additional model further represents a stage table”** is disclosed by Buckley ‘759 FIG 1 element 6, which is discussed at Column 5 line 62 “plate 6”. Note

that this “plate” holds up the object (element 8 in FIG 1), thus it functions as a stage table.

36. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
37. **Claim 5 is rejected under 35 U.S.C. 103(a)** as being unpatentable over **Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759.** Claim 5 depends from Claim 3 with one additional limitation.
38. Kolb does not expressly disclose “at least one additional model is a lighting system model that represents at least one of a magnitude, a color a type and an orientation of at least one lighting source”.
39. **“at least one additional model is a lighting system model that represents at least one of a magnitude, a color, a type and an orientation of at least one lighting source”** is disclosed by Buckley ‘759 Column 2 line 5 “Structured light and machine vision combine to form the sensors...This combination has been used to determine the location of a surface for several decades.”
40. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to

Art Unit: 2123

modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

41. **Claim 6 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 6 depends from Claim 3 with one additional limitation.

42. Kolb does not expressly disclose “the first model comprises a representation of at least one of a position and an orientation of the at least one object relative to the stage”.

43. **“the first model comprises a representation of at least one of a position and an orientation of the at least one object relative to the stage”** is disclosed by Buckley ‘759 at Column 3 line 45 “calibrating individual component as well as the inspection apparatus itself...the part is conveyed past the machines sensors by a transport mechanism”. This transport mechanism is “plate 6” in FIG 1.

44. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “determine the location of a surface” according to Buckley ‘759 Column 2 line 5.

45. **Claim 7 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of

Art Unit: 2123

Stevenson et al "Modeling optical vision systems with innovative software", Vision Systems Design, January 1999. Claim 7 depends from Claim 1 with two additional limitations.

46. **"a lens system model"** is disclosed by Kolb at FIG 1 "double-Gauss lens".

47. Kolb does not expressly disclose "a lighting system".

48. **"a lighting system"** is disclosed by Stevenson at Page 33 first full paragraph "rays from an off-axis collimated light source are traced onto the model car. Rotating the optical system and its source makes it possible to confirm complete illumination of the target (car) object. The optical system is then ready for a large-scale imaging ray trace."

49. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Stevenson and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to verify "the optical-vision-system geometry and light-source position" according to Stevenson Page 33 first full paragraph.

50. **Claim 8 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 8 depends from Claim 1 with four additional limitations.

51. **"world model"** is disclosed by is disclosed by Kolb et al at page 317, second column, third bullet, "a vision system may want to test whether its internal model of the world matches what is being observed".

52. **“static model”** is inherently disclosed by Kolb Page 317 second column, last paragraph “simulation of depth of field and motion blur”. Motion blur inherently discloses movement between the relative positions of the camera and the object. Setting the movement velocity to zero yields a static model. The Examiner further takes official notice that models and objects are generally presumed to be static unless they are expressly defined as moving. In other words, Kolb discloses a moving model which is more complex than a static model, yet inherently discloses (or collapses down to) the static model when movement velocity is set to zero (static).
53. Kolb does not expressly disclose “a stage model” or “a component model”.
54. **“stage model”** is disclosed by Buckley ‘759 FIG 1 element 6, which is discussed at Column 5 line 62 “plate 6”. Note that this “plate” holds up the object (element 8 in FIG 1), thus it functions as a stage model.
55. **“component model”** is disclosed by Buckley ‘759 at Column 3 line 45 “calibrating individual component”.
56. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
57. **Claim 9 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of

Art Unit: 2123

Buckley et al US Patent 6,064,759. Claim 9 depends from Claim 1 with one additional limitation.

58. **“world model is at least partially constructed from at least one of the static model, the stage model and the component model”** is disclosed by Kolb et al at page 317, second column, third bullet, “a vision system may want to test whether its internal model of the world matches what is being observed”,
59. Applicant is advised that should Claim 8 be found allowable, then Claim 9 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).
60. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
61. **Claim 10 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1). Claim 10 depends from Claim 1 with two additional limitations.

Art Unit: 2123

62. **“rendering engine”** is disclosed by Kolb et al at page 317 first column, second full paragraph, “Figure 8 shows four images generated by the renderer and the lenses used in taking each of them”.
63. **“lens effect engine”** is disclosed by Kolb et al at page 317 first column, second full paragraph, “Figure 8 shows four images generated by the renderer and the lenses used in taking each of them”.
64. **Claim 11 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1). Claim 11 depends from Claim 1 with two additional limitations.
65. **“rendering engine”** is disclosed by Kolb et al at page 317 first column, second full paragraph, “Figure 8 shows four images generated by the renderer and the lenses used in taking each of them”.
66. **“lens effect engine”** is disclosed by Kolb et al at page 317 first column, second full paragraph, “Figure 8 shows four images generated by the renderer and the lenses used in taking each of them”.
67. Further, Applicant is advised that should Claim 10 be found allowable, then Claim 11 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

68. Claim 12 was withdrawn.

69. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 13 depends from Claim 1 with one additional limitation.

70. Kolb does not disclose “control instruction generation system”.

71. **“control instruction generation system”** is disclosed by Buckley ‘759 at Column 1 line 26 “The system combines SLMV hardware with a computer software simulation of the part, the structured light and the camera’s view.” Note that Buckley’s “system” inherently discloses control instructions similar to those described by the specification at Page 10 line 16 “As shown in Fig. 4A, the control routine starts at step S100 and continues to step S102. In step S102, components of the virtual world, such as a table, camera, lighting, etc. are initialized”.

72. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

73. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of

Buckley et al US Patent 6,064,759. Claim 14 depends from Claim 13 with one additional limitation.

74. Kolb does not expressly disclose “inspection program generation system”.

75. **“inspection program generation system”** is disclosed by Buckley ‘759 Column 1 line 32 “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection”.

76. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

77. **Claim 15 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 15 depends from Claim 1 with one additional limitation.

78. Kolb does not expressly disclose “control instruction generation system comprises a motion command generation system”.

79. **“control instruction generation system comprises motion command generation system”** is disclosed by Buckley ‘759 at Column 3 line 38 “Part transport mechanisms for moving the object through the inspection region are described”.

80. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to "reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection" according to Buckley '759 Column 1 line 32.
81. **Claim 16 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 16 depends from Claim 1 with one additional limitation.
82. **"second model characterizes an image capture system and a lens system"** is disclosed by Kolb at Page 318, first column, first paragraph "Image formation is simulated by a modified distributed ray tracing algorithm that traces rays through the lens system in order to compute the exposure on the film plane."
83. **Claim 17 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 17 depends from Claim 16 with one additional limitation.
84. **"the second model characterizes at least one of an aperture, a focal length, an image magnification, and an optical system geometry of the lens system"** is disclosed by Kolb at Page 318 Figure 1 "double-Gauss lens".

- 85. Claim 18 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 18 depends from Claim 16 with one additional limitation.
- 86. “the second model characterizes at least one of an imaging system pixel size and an imaging system pixel spacing of an image capture system”** is disclosed by Kolb at Page 322 first full paragraph “In our model, a pixel’s value is proportional to the radiant power falling on a hypothetical pixel-sized sensor in the image plane...pixel area”.
- 87. Claim 19 has been withdrawn.**
- 88. Claim 20 (Amended) is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Amended Claim 20 depends from Claim 1 with one additional limitation.
- 89. “means for modifying at least one of the first and second models”** is disclosed by Kolb at Page 323 Figure 9 “Images synthesized with a 35mm wide-angle lens using, in order of decreasing accuracy, the full lens simulation (left), thick approximation (center), and the standard model (right).” Note that these images demonstrate modifications of the second model (optical system) from full lens, to thick approximation, and then to standard.

90. **Claim 21 (Amended) is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Amended Claim 21 depends from Claim 1 with one additional limitation.
91. Kolb does not expressly disclose “the vision system hardware component simulation system simulates at least one operation of the machine vision inspection system independent of at least one component of the machine vision inspection system”.
92. **“the vision system hardware component simulation system simulates at least one operation of the machine vision inspection system independent of at least one component of the machine vision inspection system”** is disclosed by Buckley ‘759 Column 1 line 26 “The system combines SLMV hardware with a computer software simulation of the part, the structured light and the camera’s view.” Thus, Buckley’s system simulates the” structured light and the camera’s view” independent of the machine vision inspection system’s physical structured light and physical camera.
93. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
94. **Claim 22 (Amended) is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US

Art Unit: 2123

Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1). Amended

Claim 22 is an independent claim with two limitations.

95. The first limitation has three parts (a1, a2, a3), and the second limitation has 2 parts (b1, b2).

96. (a1)“**generating a simulated focus-dependent image of a virtual world**” is disclosed by Kolb et al at Page 320 first heading “3.3 Focusing”.

97. (a2)“**a first model representing at least one object**” is disclosed by Kolb et al at page 317, second column, third bullet, “a vision system may want to test whether its internal model of the world matches what is being observed”, and alternately disclosed at Page 318, footnote number 1, “object space to the left of the lens system”.

98. (a3)“**a second model that characterizes an optical system of a machine vision system being simulated**” is disclosed by Kolb et al at Page 317, second column, third bullet, “In some machine systems and scientific applications it is necessary to simulate cameras and sensors accurately”, and alternately at Page 318 first paragraph “This paper describes a physically-based camera model for computer graphics. The model is capable of simulating the image formation of a particular physical lens system”.

99. (b1)“**a processor that generates a focus dependent image of a virtual world containing the at least one object based upon the first model and the second model**” is disclosed by Kolb et al at Page 320 first heading “3.3 Focusing”.

100. Kolb does not expressly disclose “user interface representation of a user interface of the machine vision system being simulated” (the second part of the second limitation (b2)).

101. **(b2)“user interface representative of a user interface of the machine vision system being simulated”** is disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. Note that fighter heads-up displays typically include icons indicating positions of other fighters and the position of the horizon which are acquired by radar, and note that radar is a machine vision system. Thus, the simulated heads-up display is a user interface representative of a user interface of the machine vision system being simulated (fighter radar system).
102. Alternately, (c2) “user interface representative of a user interface of the machine vision system being simulated” is disclosed by Streid ‘845 at Column 1 line 49 “Simulation systems provide fully simulated NVG imagery projected onto displays”. Thus, the simulated heads-up display is the user interface representative of a user interface (NVG or night vision goggles) of the machine vision system (night vision system).
103. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley US Patent 6,064,759 Column 1 line 32.
104. **Claim 23 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view

Art Unit: 2123

of Buckley et al US Patent 6,064,759. Claim 23 depends from Claim 22 with three additional limitations.

105. **“processing optical system parameters”** is disclosed by Kolb at Page 318 second paragraph “simulating the lens system”.

106. Kolb does not expressly disclose “relative position and orientation” or “processing component data”.

107. **“relative position and orientation of the at least one object and the optical system”** is disclosed by Buckley ‘759 at FIG 1 object element 4, and machine vision camera element 2.

108. **“processing component data”** is disclosed by Buckley ‘759 at Column 6 line 37 “Applying a centroid algorithm to the voltages determines the voltage-weighted centroid location of the pixels”.

109. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

110. **Claim 24 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 24 depends from Claim 23 with one additional limitation.

Art Unit: 2123

111. Kolb does not expressly disclose “lighting system parameters”.
112. **“lighting system parameters including at least one of a position and an orientation relative to at least one object, a magnitude, a color and a type of at least one lighting source”** is disclosed by Buckley ‘759 at FIG 1 object element 4, and machine vision camera element 2, and laser line source element 3.
113. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
114. **Claim 25 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 25 depends from Claim 22 with three additional limitations.
115. Kolb does not expressly disclose “first model comprises at least one of” or “generating the simulated image based on at least one of”.
116. **“first model comprises at least one of a component model, a stage model and a static model”** is disclosed by Buckley ‘759 at Column 3 line 45 “calibrating individual component as well as the inspection apparatus itself”.
117. **“generating the simulated image based on at least one of the component model, the stage model and the static model”** is disclosed by Buckley ‘759 at Column

Art Unit: 2123

1 line 28 "The simulation uses a geometric model software that can graphically render the part onto a computer screen".

118. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to "reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection" according to Buckley '759 Column 1 line 32.

119. **Claim 26 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 26 depends from Claim 25 with one additional limitation.

120. Kolb does not expressly disclose "movable stage component".

121. **"stage model represents at least one of a stage table and a movable stage component"** is disclosed by Buckley '759 at FIG 1 element 6 "plate". This is further described at Column 5 line 61 "Object 4 is mounted on movable plate 6, which is moved in a rectilinear motion by a precision transport system." Thus, the "plate 6" holds the "object 4", thus serving as a movable stage component for the object.

122. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to

Art Unit: 2123

“reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

123. **Claim 27 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 27 depends from Claim 26 with one additional limitation.

124. Kolb does not expressly disclose “position and an orientation”.

125. **“component model includes a representation of at least one of a position and an orientation of the at least one object on the movable stage component”** is disclosed by Buckley ‘749 at Column 5 line 23 “The preferred embodiment of the present invention relies primarily on the accurate measurement of surfaces”. Note that measuring the surfaces of an object fixes the position and orientation of said object. Further, the measured “Object 4 is mounted on movable plate 6” according to Column 5 line 61. Alternately, this limitation is also disclosed by Buckley ‘749 at Column 23 line 27 “Rotational Mispositioning Errors...”

126. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

127. **Claim 28 has been withdrawn.**

128. **Claim 29 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 29 depends from Claim 22 with one additional limitation.

129. Kolb does not expressly disclose “at least one inspection program instruction based on the simulated image”.

130. **“at least one inspection program instruction based on the simulated image”** is disclosed by Buckley ‘749 Column 24 Line 28 “finding the minimum value of the E_{obj} function as the object’s simulation is rotated through rotation angles close to those found in the previous gross step”.

131. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

132. **Claim 30 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 30 depends from Claim 22 with one additional limitation.

Art Unit: 2123

133. Kolb does not expressly disclose “at least one inspection program instruction is based upon a user input”.
134. **“at least one inspection program instruction is based upon a user input”** is disclosed by Buckley ‘749 at Column 29 line 41 “The perspective of the isometric view can be rotated or magnified by the operator to get the best vantage of important surfaces”.
135. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
136. **Claim 31 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 31 depends from Claim 22 with one additional limitation.
137. Kolb does not expressly disclose “generating at least one control instruction based on the simulated image”.
138. **“generating at least one control instruction based on the simulated image”** is disclosed by Buckley ‘759 Column 2 line 55 determine by simulation which surface or edge points are required for inspection, 2) direct this information to the inspection machine that will extract the 3-space coordinates of the required points form a similar physical object”.

139. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to "reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection" according to Buckley '759 Column 1 line 32.
140. **Claim 32 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 32 depends from Claim 31 with one additional limitation.
141. Kolb does not expressly disclose "the at least one control instruction based on the simulated image comprises generating an inspection program".
142. **"the at least one control instruction based on the simulated image comprises generating an inspection program"** is disclosed by Buckley '759 Column 2 line 55 "determine by simulation which surface or edge points are required for inspection, 2) direct this information to the inspection machine that will extract the 3-space coordinates of the required points form a similar physical object".
143. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to "reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection" according to Buckley '759 Column 1 line 32.

144. **Claim 33 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 33 depends from Claim 31 with one additional limitation.

145. Kolb does not expressly disclose “generating the at least one control instruction based on the simulated image comprises generating a motion command”.

146. **“generating the at least one control instruction based on the simulated image comprises generating a motion command”** is disclosed by Buckley ‘759 Column 2 line 55 “determine by simulation which surface or edge points are required for inspection, 2) direct this information to the inspection machine that will extract the 3-space coordinates of the required points form a similar physical object”. Note that extracting the 3-space coordinates requires moving the object through the inspection system as disclosed by Buckley ‘759 at Column 5 line 61 “Object 4 is mounted on movable plate 6, which is moved in a rectilinear motion by a precision transport system.”

147. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

148. **Claim 34 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent

5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 34 depends from Claim 22 with two additional limitations.

149. Kolb does not expressly disclose “altering at least one of the first and second models based on at least one user input” or “modifying the simulated image based on the altered one of the first and second models”.

150. **“altering at least one of the first and second models based on at least one user input”** is disclosed by Buckley ‘749 at Column 29 line 41 “The perspective of the isometric view can be rotated or magnified by the operator to get the best vantage of important surfaces”. Note that this change in perspective is accomplished by changing the relative position and relative orientation of the first model (object) with respect to the second model (optical system). This can be accomplished either by moving and rotating the first model, or by moving and rotating the second model.

151. **“modifying the simulated image based on the altered one of the first and second models”** is disclosed by Buckley ‘749 at Column 29 line 41 “The perspective of the isometric view can be rotated or magnified by the operator to get the best vantage of important surfaces”.

152. Note that this change in perspective is accomplished by changing the relative position and relative orientation of the first model (object) with respect to the second model (optical system). This can be accomplished either by moving and rotating the first model, or by moving and rotating the second model. The simulated image of the perspective of the isometric view is thus modified by rotation or magnification.

Art Unit: 2123

153. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to "reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection" according to Buckley '759 Column 1 line 32.

154. **Claim 35 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 35 depends from Claim 34 with one additional limitation.

155. Kolb does not expressly disclose "repeating and altering the modifying steps".

156. **"repeating and altering the modifying steps"** is inherently disclosed by Buckley '749 at Column 29 line 41 "The perspective of the isometric view can be rotated or magnified by the operator to get the best vantage of important surfaces". Note that rotation and magnification appear to be different operations, and would be performed sequentially by the operator. Thus, the operator would rotate once or more until the desired rotation was achieved, and then magnify once or more until the desired magnification was achieved. The number of steps that this would require would depend upon the exact software program and upon the level of operator skill.

157. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to

“reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

158. **Claim 36 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 36 depends from Claim 35 with one additional limitation.

159. Kolb does not expressly disclose “repeating continues until the simulated image represents a machine vision state desired by the user”.

160. **“repeating continues until the simulated image represents a machine vision state desired by the user”** is inherently disclosed by Buckley ‘749 at Column 29 line 41 “The perspective of the isometric view can be rotated or magnified by the operator to get the best vantage of important surfaces”. Note that rotation and magnification appear to be different operations, and would be performed sequentially by the operator. Thus, the operator would rotate once or more until the desired rotation was achieved, and then magnify once or more until the desired magnification was achieved. The number of steps that this would require would depend upon the exact software program and upon the level of operator skill. The steps will continue until the operator/user achieves “the best” machine vision state.

161. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to

“reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

162. **Claim 37 (Amended) is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 37 (Amended) is an independent claim with three limitations.

163. **“rendering a synthetic image of at least one object”** is disclosed by Kolb at Page 323 second full paragraph “Figure 8 shows four images generated by the renderer and the lenses used in taking each of them”.

164. Kolb does not disclose “providing the synthetic image” or “selecting a machine control”.

165. **“user interface representative of a user interface of the machine vision system being simulated”** is disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. Note that fighter heads-up displays typically include icons indicating positions of other fighters and the position of the horizon which are acquired by radar, and note that radar is a machine vision system. Thus, the simulated heads-up display is a user interface representative of a user interface of the machine vision system being simulated (fighter radar system).

166. Alternately, “user interface representative of a user interface of the machine vision system being simulated” is disclosed by Streid ‘845 at Column 1 line 49

Art Unit: 2123

“Simulation systems provide fully simulated NVG imagery projected onto displays”.

Thus, the simulated heads-up display is the user interface representative of a user interface (NVG or night vision goggles) of the machine vision system (night vision system).

167. **“selecting a machine control instruction based at least in part on the synthetic image”** is disclosed by Buckley ‘749 at Column 29 line 41 “The perspective of the isometric view can be rotated or magnified by the operator to get the best vantage of important surfaces”. Note that the operator can select rotation or magnification based on the synthetic image (or “geometric model” according to Buckley’s terminology at Column 29 line 4).
168. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
169. **Claim 38 (Amended) is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 38 (Amended) depends from Claim 37 (Amended) with one additional limitation.
170. Kolb does not expressly disclose “updating in real time”

171. **“updating in real-time the synthetic image in response to a user altering the representation of at least one component of the machine vision system”** is disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. The fighter simulation updates in real-time the synthetic image of the enemy airplane during dogfights in response to user altering the relative position and orientation of the enemy airplane in relation to the camera (the user’s simulated airplane).
172. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
173. **Claim 39 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 39 depends from Claim 37 (Amended) with one additional limitation.
174. **“depth of focus”** is disclosed by Kolb at Page 317 second column last full paragraph “simulation of depth of field”.
175. **Claim 40 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view

of Buckley et al US Patent 6,064,759. Claim 40 depends from Claim 37 (Amended) with two additional limitations.

176. Kolb does not expressly disclose “presenting the synthetic image to a user” or “receiving a user input, wherein the machine control instruction is in response to the user input”.
177. **“presenting the synthetic image to a user”** is disclosed by Kolb at Page 323 second full paragraph “Figure 8 shows four images generated by the renderer and the lenses used in taking each of them”.
178. **“receiving a user input, wherein the machine control instruction is in response to the user input”** is disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. The fighter simulation updates in real-time the synthetic image of the enemy airplane during dogfights in response to user altering the relative position and orientation of the enemy airplane in relation to the camera (the user’s simulated airplane).
179. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.
180. **Claim 41 (Amended) is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and

further in view of Buckley et al US Patent 6,064,759. Claim 41 (Amended) is an independent claim with 5 limitations.

181. (a)“initializing a scene of the synthetic image of at least one object” is inherently disclosed by Streid ‘845 at Column 1 line 49 “Simulation systems provide fully simulated NVG imagery projected onto displays”. NVG stands for Night Vision Goggles. Every fighter simulation inherently requires an initialization scene, which could have the synthetic image an approaching enemy fighter. Alternately, Kolb discloses “Figure 8 shows four images generated by the renderer and the lenses used in taking each of them” at Page 323 second full paragraph.
182. (b)“adding a workpiece model of at least one workpiece to the scene” is inherently disclosed by Streid ‘845 at Column 1 line 49 “Simulation systems provide fully simulated NVG imagery projected onto displays”. NVG stands for Night Vision Goggles. Additional enemy fighters (workpiece models) can join the dogfight. Alternately, the user can launch simulated missiles (workpiece models) at the enemy fighters.
183. (c)“obtaining at least one of a position and an orientation of the stage relative to an optical system” is inherently disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. The simulated artificial horizon displays orientation of the stage (the ground), and the simulated altimeter displays distance to the ground (position) relative to the airplanes radar system. Alternately, enemy fighters are displayed in

Art Unit: 2123

position relative to the user's simulated fighter. Alternately, Buckley '759 FIG 1 discloses position and orientation of a stage ("plate 6") relative to an optical system.

184. (d)**"rendering the scene based on at least one of the characteristics of the optical system and the obtained relative position and orientation of the optical system"** is inherently disclosed by Thomas '450 at Column 5 line 39 "Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter". The simulated artificial horizon and the simulated altimeter displays distance to the ground (position) relative to the airplanes radar system. Alternately, icons display the enemy fighters relative to the position and orientation of the user's simulated fighter.

185. (e)**"user interface representative of a user interface of the machine vision system being simulated"** is disclosed by Thomas '450 at Column 5 line 39 "Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter". Note that fighter heads-up displays typically include icons indicating positions of other fighters and the position of the horizon which are acquired by radar, and note that radar is a machine vision system. Thus, the simulated heads-up display is a user interface representative of a user interface of the machine vision system being simulated (fighter radar system).

186. Alternately, **"user interface representative of a user interface of the machine vision system being simulated"** is disclosed by Streid '845 at Column 1 line 49 "Simulation systems provide fully simulated NVG imagery projected onto displays". Thus, the simulated heads-up display is the user interface representative of a user

Art Unit: 2123

interface (NVG or night vision goggles) of the machine vision system (night vision system).

187. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845) to modify Kolb. One of ordinary skill in the art would have been motivated to do this to "reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection" according to Buckley '759 Column 1 line 32.

188. **Claim 42 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al "A Realistic Camera Model for Computer Graphics" in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 42 depends from Claim 41 (amended) with two additional limitations.

189. **"determine if any lens effects are to be applied to the rendered image"** is disclosed by Kolb at Page 323 second full paragraph "Figure 8 shows four images generated by the renderer and the lenses used in taking each of them". Selecting any of Kolb's advanced lens models is a determination to introduce lens effects (in contrast to using a simple pin-hole lens model which will not introduce any lens effects).

190. **"if any lens effects are to be applied, applying the lens effects to the rendered image"** is disclosed by Kolb at Page 323 second full paragraph "Figure 8 shows four images generated by the renderer and the lenses used in taking each of them".

191. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley '759 and Thomas '450 (or alternately Streid '845)

to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

192. **Claim 43 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 43 depends from Claim 41 (Amended) with two additional limitations.

193. Kolb does not expressly disclose the two additional limitations “determining if an external view” or “rendering the external view”.

194. **“determining if an external view is to be rendered based on the rendered scene”** is disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. One display is a “bird’s eye” view (external view) of the user’s fighter and the enemy fighters positioned around it. This is an external view. The simulation user can toggle this display on or off (“determining if an external display is to be rendered”) based on the rendered scene.

195. **“rendering the external view”** is disclosed by Thomas ‘450 at Column 5 line 39 “Window 1 includes a simulated heads-up display to complete the simulation for a typical tactical fighter”. One display is a “bird’s eye” view (external view) of the user’s fighter and the enemy fighters positioned around it. This is an external view.

196. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Buckley ‘759 and Thomas ‘450 (or alternately Streid ‘845)

to modify Kolb. One of ordinary skill in the art would have been motivated to do this to “reduce the time required to make inspections and to improve the accuracy and ease of setup of the inspection” according to Buckley ‘759 Column 1 line 32.

197. **Claim 44 is rejected under 35 U.S.C. 103(a)** as being unpatentable over Kolb et al “A Realistic Camera Model for Computer Graphics” in view of Thomas US Patent 5,137,450 (and alternately in view of Streid US Patent 6,196,845 B1), and further in view of Buckley et al US Patent 6,064,759. Claim 43 depends from Claim 42 with one additional limitations.

198. **“lens effects include at least a depth of focus”** is disclosed by Kolb at Page 317 second column last paragraph “simulation of depth of field”.

Response to Arguments-introduction

199. Applicant’s arguments filed 4/15/02 (Paper # 8) have been fully considered.

Response to Arguments-substantial amendments (Paper #8, Page 4)

200. Examiner respectfully disagrees with Applicant’s statement that “the claims are amended for clarity, and not to overcome prior art”. All of the independent claims (1, 22, 37, and 41) have substantially modified. For example, on page A-1, marked up Claim 1, second limitation reads “a second model representing at least an optical system corresponding to a machine vision system being simulated”. This amendment results in taking what was previously a mere intended use from the preamble and incorporating it into a limitation. That is a substantial amendment.

201. For a second example, on page A-1, marked up Claim 1, third limitation reads “a processor that generates an focus-dependent image of a virtual world containing the the at

Art Unit: 2123

least one object based upon the first model and the second model, the image presented through a user interface representative of a user interface of the machine vision system being simulated.”

202. Because all of independent claims have been substantially amended, the Examiner has presented new arguments for rejections of all pending claims. Therefore, the Applicant’s arguments relating to prior art are moot.

203. Additionally, the 35 USC 112 rejections of claims (unamended claims) from the first office action have been withdrawn. The Applicant’s arguments regarding 35 USC 112 and interpretation by one of ordinary skill in the art are persuasive.

Response to Substantial Amendments-FINAL OFFICE ACTION

204. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

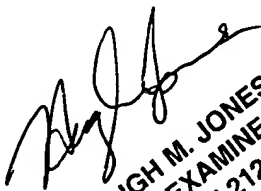
205. A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Art Unit: 2123

Conclusion

206. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eduardo Garcia-Otero whose telephone number is 703-305-0857. The examiner can normally be reached on Monday through Thursday from 9:00 AM to 7:00 PM.
207. If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Kevin Teska, can be reached at (703) 305-9704. The fax phone numbers for this group are:
208. (703) 746-7238 --- for communications after a Final Rejection has been made;
209. (703) 746-7239 --- for other official communications; and
210. (703) 746-7240 --- for non-official or draft communications.
211. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the group receptionist, whose telephone number is (703) 305-3900.

* * * *


DR. HUGH M. JONES
PATENT EXAMNER
ART UNIT 2123